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Sarcoma of the Pons, and Glio-Sarcoma of the Cerebellum.

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SARCOMA OF THE PONS AND GLIO-SARCOMA OF THE CEREBELLUM.

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The following two instances of tumor of the brain are reported in order to increase the number of such cases recorded and described in medical literature.

Case 1. Sarcoma of the Pons.—This case occurred in the Cook County Hospital, where Dr. E. T. Edgerly ascertained and wrote down the clinical history as well as the results of the physical examination; the writer made the post-mortem examination and examined the tumor microscopically.

Man, single, baker, German by birth, 37 years old, was admitted to the Cook County Hospital of Chicago, April 5, 1890. He was his parents' only child; the parents were both dead, the cause of death being unknown. He denied having had any venereal disease, said that he drank beer in moderate quantities, and that he had never been ill before his recent sickness, which began with headache three months ago, since which time he had been unable to work on account of the pain, which was of a dull persistent character, with nocturnal exacerbations, principally frontal, but often extending over the entire top of the head. Two days before admission he fell on the sidewalk in a fit of faintness, but did not lose consciousness entirely; he had been troubled with dyspepsia; the bowel and urinary functions had been abjectively normal. The patient on admission is mentally dull and a clear cut history cannot be obtained.

Present Condition.—Patient is well nourished; he lies in bed groaning and complaining loudly of pain in the head, which he grasps with his hands; the right eye is tightly closed, the left eye is half open; the pupil of the right eye is somewhat contracted, both pupils respond to light. Movement of the eyeballs seem to be limited, particularly as

regards motion upwards and to the left. The tongue is normal and does not deviate on protrusion; the lines in the face seem better marked on the right side. Physical examination of the chest and abdomen is negative; there is no ankle clonus; the patellar and cremasteric reflexes are normal; muscle reflexes are universally present; rough tests indicate the tactile sensibility to be much impaired, thus two points three inches apart cannot be distinguished on the hands or the feet; when half an inch apart on the tongue the two points cannot be separated. Taché cerebrale is very distinct.

Pulse 64, respiration 16, temperature 97.6°.

Ophthalmoscopic examination by Dr. Mary C. Fowler: the discs cannot be outlined at all, yet the vessels are not large and do not pulsate. This condition is more marked in the left eye than in the right.

April 12. Patient suddenly became unconscious while eating and unable to swallow the mouthful of food he had taken; the extremities became cold, profuse perspiration broke out on the skin and the pupils dilated. Patient is taking iodide of potassium in increasing doses.

April 14. Lies in stupor; requires catheterization; refuses food. Right pupil dilated, does not respond to light. Supra-orbital pressure arouses patient sufficiently to answer questions. The right side of the body seems to respond to stimulation more quickly than the left, and often he moves the right side in response to irritation of the opposite half.

At 8 P.M. Dr. Murphy removed a button of bone with the trephine from the skull on the upper end of the right Rolandic fissure. The dura was dense. An aseptic aspirating needle was passed into the brain in all directions from the trephine opening, but no abnormal fluids were obtained nor resisting body encountered. Replacement of button, suture. 12 P.M. Death.

CLINICAL CHART.

Date.	Temp.		Pulse.		Resp.	
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
4-5-'90	97.6	98	64	66	16	16
4-6-'90	99	99	70	72	16	16
4-7-'90	98.6	98	66	58	16	16
4-8-'90	98.6	98.6	60	54	18	20
4-9-'90	98.6	98.8	60	58	18	16
4-10-'90	98	98.6	58	60	16	17
4-11-'90	98.2	98.4	56	54	24	20
4-12-'90	98	98.5	60	60	20	20

Section twenty-four hours post-mortem:

The trunk cavities were empty. The heart was of normal size, the semilunar valves competent to water; the mitral and tricuspid orifices admitted three and four finger tips respectively; the endocardium was smooth and the muscular tissue firm and light greyish-red in color. The fossa ovalis presented many small perforations. The lungs contained much frothy and bloody fluid. The abdominal organs presented no special change, contained no tumors. In the scalp over the right parietal eminence was a curved incision and beneath the flap thus outlined was a circular opening in the skull containing an accurately fitting button of bone. The dura was free from thickening, the Pacchionian granulations were exuberant. The pia was quite universally adherent to the surface of both the vertex and the base of the brain. There were small clots of blood in the right Sylvian fissure at the base; there was a small clot along the post communicant artery, but the vessel itself was intact. In the region of the upper third of the right pre- and post-central convolutions, beneath the trephine openings, were many small punctures in the membrane and in the brain substance. There was some clear fluid in each lateral ventricle. The brain substance in the hemispheres was macroscopically normal and free from any focal disease. On the internal half of the ventricular aspect of each thalamus were slate-colored, slightly raised areas, and on the left thalamus was a gelatinous body as large as a flax-seed.

The choroid plexus and the pineal gland were thickened and the peduncles of the pineal gland contained some slightly discolored areas. The slaty areas in the thalami extended into the substance for about 1 mm. There were no areas of softening in thalami or in the crura. The pons was larger than normal, but the enlargement was symmetrical, at the widest portion it measured 5 cm. across from right to left. In the central portion of the pons, inclining perhaps to the right, was an oval, firm mass, 3.5 cm. in diameter and 5 cm. long, the long diameter lying in a dorso-ventral direction. The tumor was but loosely imbedded in the pons; having no organic connection with the pontine substance, and on attempted manipulation it slipped out entirely. It weighed 17 grams; it was of firm consistency, greyish in color on the cut surface, with many small hæmorrhagic areas, old and young, scattered through its substance. The fourth ventricle was empty; the medulla and cerebellum were normal. The spinal cord was not examined.

Microscopic examination of the tumor, after hardening

in Mueller's fluid, shows that it is made up of rather delicate, quite small round and spindle shaped cells, with distinct deeply colored nuclei, densely packed together; there are places consisting principally of round cells, and in other spots mostly spindle shaped cells are found; no distinct stroma can be made out, perhaps on account of the dense crowding together of cells. There are a number of irregular spaces without any plain wall separate and distinct from the tumor structure; in some places the cells immediately surrounding these spaces are, however, much like normal connective tissue cells, often these spaces are quite empty; some contain red blood corpuscles only or corpuscles mixed with tumor cells; there are also found quite large areas consisting of blood infiltrating with the substance of the neoplasm; in such foci the fibrinous meshwork is usually plain. At the margin of one of these areas of infiltration is seen a distinct, thin-walled blood-vessel, filled with blood which in one place seems to be breaking into the tumor. There are also found a few areas of amorphous, yellowish material. The areas of discoloration observed with the naked eye upon the caudal surface of the thalami consist of masses of round cells, irregular in outline and in size, some being large and some small, and a few seem to be intravascular; here the cells are large and not so closely aggregated as in the pons.

Diagnosis.—Round and spindle-celled sarcoma of the pons; secondary foci in the thalami.

Remarks.—It will be seen at once that the symptoms presented by this patient are readily explained by the nature and the position of the intrapontine tumor. The general symptoms such as headache, attacks of fainting and ophthalmoscopic retinal changes, occur in tumors of the pons as well as in other parts of the brain. The headache was intense, of rather uncertain localization and well-nigh continuous. In view of the fact that the pain in such cases is situated in the dura mater, it might perhaps be more reasonable to speak of the headache in this case not as a general but as a focal symptom, due to local compression or irritation of some part of the fifth nerve, near its origin, this being the nerve which supplies sensation to the dura.¹ The varying inten-

¹ Wernicke, Lehrbuch der Gehirnkrankheiten, Berlin, 1883.

sity of many of the symptoms was due in all probability to the occurrence of hæmorrhages into the tumor, which would cause sudden increase in the intracranial pressure. Thus, for instance, the attacks of fainting would result from increased pressure or sudden irritation of the nerve tracts passing through the pons due to the hæmorrhagic extravasations into the neoplasm. The examination after death showed the presence of old and recent, large and small, foci of hæmorrhage into the tumor. In fact the variations in all the symptoms was undoubtedly caused either by varying intracranial pressure or by varying direct compression of important structures in the vicinity of the tumor dependent upon the repeated congestions and hæmorrhages. The rather slight evidences of motor and sensory disturbances during the time the patient was observed in the hospital are attributable to the nature and the position of the growth; it was circumscribed, not in any way infiltrating but rather displacing, and consequently its effects upon the surrounding structures would be due entirely to pressure. The rather indefinite ocular paralysis or paresis and the equally imperfect left hemiplegia was due to the gradually increasing pressure of the tumor upon the tissues around it. The paresis of left side of the body might, for instance, be caused by pressure on part of the tumor in the right upper third of the pons before the decussation of the pyramidal tracts or in the lower left third after decussation. The symptoms were not distinct enough to decide this from a clinical standpoint, and the position of the tumor in the central part of the pons gives no clue as to which part of the tracts would be most compressed unless, indeed, it be those in the right half.

It will be observed from the temperature chart that the occurrence of hæmorrhage into the substance of the tumor was not followed by fall of temperature.

Gerhard observed that hæmorrhage into gliomas did not, like genuine cerebral hæmorrhage, cause persistent lowering of temperature, and proposed to utilize this observation in the diagnosis of this form of brain tumor; vascular sarcoma consequently appears to agree with glioma with respect to the point mentioned. The sudden death may have been due to the operation of trephining; it might also have resulted from lesions of the vagus centres due to the tumors.

The varieties of tumors occurring in the pons are practically two, glioma and sarcoma; a third is formed by a combination of these two into gliosarcoma. Gummata, tubercular foci, parasitic cysts give rise to symptoms identical with those produced by true tumors. The glioma is more frequently met with than sarcoma. Starr² collected thirty-eight cases of tumors of the pons in children and youth; of these nineteen were tubercular, ten gliomatous, five sarcomatous, two glio-sarcomatous, one cystic and one unknown. Glioma of the pons and the pons medulla transition usually take the form known as gliomatous hypertrophy; a name which Hun³ says was first proposed by Kümmel⁴ because the growth is not circumscribed but appears in the form of a diffuse hyperplasia of the parts affected, resulting in great increase in size and but little distortion of normal configuration. This name, gliomatous hypertrophy, has been used by quite a number of writers reporting cases, and among them may be mentioned Hun³ and Spitzka.⁵

Gee and Percy Kidd⁶ termed the same condition gelatiniform enlargement of the pons in their description of cases in the St. Bartholomew Hospital Reports. Glioma is nearly always an infiltrating

² M. Allen Starr, Medical News, July 12, 1889.

³ Hun, Medical News, October 1, 1887.

⁴ Kümmel, Zeitschrift für Klin. Med., B. 2, Aeft. 2, Berlin, 1883.

⁵ Spitzka, N. Y. Medical Journal, March 27, 1886.

⁶ Angel Money, London Lancet, May 12, 1883.

tumor. Histologically it consists of branched neuroglia cells many of which may be multinucleated; it takes its origin from the neuroglia and grows by proliferation of its cells; as it grows it infiltrates the brain substance, and nerve fibres and ganglia cells swell up and disintegrate as they become encroached upon, though both these elements may persist surprisingly long.⁷ It is consequently a really destructive growth in many instances.

Gliomata are frequently telangiectic. Klebs⁸ maintains that the nerve fibres and ganglion cells take part in the proliferation, and he consequently calls the tumor neuroglioma. Spitzka⁹ describes an excellent instance of neurogliomatous hypertrophy of the pons medulla transition which in parts showed actual destruction of nuclei and nerve fibres; compact nerve strands seemed to present resistance to its destructive efforts, while ganglionic and capillary districts favored its extension.

Sarcoma of the pons may occur as an independent growth, unattended by neuroglia proliferation, and it is thought to be developed from the sheaths, or the actual walls, of blood-vessels. As in the present instance they usually present rounded, extremely loosely connected, sharply defined masses of various sizes; sometimes they possess a distinct vascular membrane. The histological structure does not in any way differ from that of sarcoma elsewhere, and when hæmorrhage foci are present in great number the vessel wall will usually be found to consist of embryonal connective tissue. When some gliomatous structure is present, then the tumor is usually spoken of as a glio-sarcoma, and it may manifest the infiltration tendency usually observed in the glioma. Thus Simon¹⁰ reported a case of glio-sarcoma

⁷ Zeigler, Text-book, 1887.

⁸ Klebs, Vierteljahreschrift für prakt. Heilkunde, 125, 133.

⁹ Spitzka, Loc. Cit.

of the pons which consisted of small round cells, neuroglia cells, and in places large cells, with a manifest tendency to infiltrate surrounding structures. Most authors expressly state that sarcoma of the pons is not infiltrating as a general rule (Zeigler, Wernicke, Eichhorst); Henoch,¹¹ however, details an intra-pontine sarcoma which presented no sharp boundary, but which seemed to extend diffusely into the substance of the pons from a number of minute foci secondary to the principal mass.

While glioma and neuro-glioma of the pons, as well as of other parts of the brain, usually appear single, sarcoma tends to give rise to vascular metastasis, which is also shown in the present instance in the secondary foci in the thalami, some of which are quite distinctly intra-vascular.

Case 2. Glio-sarcoma of the Cerebellum.—The following case was in the Cook County Hospital in a homœopathic ward in the spring of 1890, but there is no record extant of the case from that time, and consequently I can only give such clinical facts as have been gathered from family and friends after the patient's death.

Man, age 45; was in good health up to May, 1885, weighing 200 pounds, and of imposing physique. At about that time he was engaged in raising an old building, and his son crawled under the building; fearing some injury, he attempted to drag him out, and during his efforts, the building fell, striking him on the back of the head and the neck, and driving his face into the sand. Owing to his great strength, he was able to extract himself, producing in so doing lacerated scalp wounds. He recovered from his wounds, and did not complain of any pain until the following winter, when he suffered for several months with severe headache, which was diagnosed by his attending physician as neuralgia. The summer following he did his usual work, but he never seemed quite well. The second winter the pain in the head returned, was principally occipital, and this time it was worse than before; he also had vertigo and nausea. The remissions in the headache grew shorter and the attacks longer, and from this time (1888) until his death

¹⁰ Simon. Zur Casuistik der Tumoren der Pons, 1887.

¹¹ Henoch, Charité-Annalen, V, 1880, p. 461.

(July 5, 1890) the pain in the head steadily increased, until he at last died from exhaustion. For a short time before death he was totally blind. He was treated from time to time in hospitals, by ordinary practitioners and by authoritative specialists, under various diagnoses, a favorite one being spinal meningitis; he was blistered and burnt, and received all the anodynes in the pharmacopœia. The above facts were obtained principally from Dr. Charles Caldwell, of Chicago, to whom I am greatly indebted for the request to make the post-mortem examination. The doctor adds: I knew him personally for many years, but I never had him under my professional care. I have never, in a practice of twenty-five years' duration, seen any one suffer such terrific pain as did this man.

The post-mortem examination was made twenty-seven hours after death. The neck and head only were examined.

Examination of the cervical spine, of the cervical portion of the spinal cord and of the organs of the neck was negative. The calvarium was free from any change; the dura was very tense, and could not be pinched up into a fold anteriorly near the crista galli; there was no fluid in the subdural space; the brain filled the cavity completely, the convolutions were much flattened, the sulci apparently obliterated. The pia showed uniform injection of its vessels, large and small, and at a little distance it presented a rosy or pink color. It was not adherent to the dura, but it peeled from the cerebral surface with difficulty. On removing the brain, clear fluid spouted like a fountain stream from the vicinity of the base beneath the hypophysis. Inspection of the brain shows uniform pinkish color, due to vascular injection; this is the case both in the dorsal and the ventral portions. The brain substance is very firm; the encephalic cavities contain much clear, almost colorless fluid, and they appear enlarged, dilated; the velum over the third ventricle is distended, and appears like a greyish band; the fourth ventricle is empty; the oblongata seems compressed. Underneath the tentorium is seen a hard, nodular projection from the left cerebellar hemisphere; it is covered by a thin stratum of cerebellar substance and by thickened pia, in which run large, tortuous vessels. To be more accurate, it is found that the postero-superior lobe of the left hemisphere is occupied by an oval tumor, presenting a projection beneath the tentorium. The long or dorso-ventral diameter of this tumor is 2, the short or verted, $1\frac{1}{2}$, and the transverse, $1\frac{1}{2}$ inches; it encroaches some on the vermes, *i. e.*, beyond the median line; it is everywhere surrounded by cerebellar substance which, dorsally, is very

thin, and in the thickened pia are numerous large, tortuous vessels, especially around periphery of the tumor projection. The cut surfaces of the tumor show areas of hemorrhage of irregular size and age, large and small districts of homogeneous, greyish-yellow, gelatinous substance in a bed of firm, whitish-grey tissue. The tumor seems simply imbedded in the cerebellum; it has no distinct capsule, and yet it has no distinct connection with the cerebellum except the vessels seem to pass into it on all sides—especially, however, from above. It cannot be said that there is much softening around the tumor.

Microscopical examination shows this tumor to consist of various kinds of tissue. In places, especially at the peripheral portions, it is composed of branching cells like the neuroglia cells; the fibrils are delicate and the cells small, with large nuclei; in an occasional cell more than one nucleus is seen. In the central portions there are areas of pure round cells, without projections, and in every way like the cells in round-celled sarcomas; then, again, there are more or less homogeneous areas without any definite cellular structure; there are also foci, composed of granular brownish pigment and blood corpuscles, as well as areas of recent hemorrhagic infiltration. The vessels are numerous and large, comparatively speaking, with many saccular dilatations, and the vessel walls are all very thin, and, in places, are simply canals, containing blood, without distinct walls; in two places blood is seen in the act of passing into the tumor through the embryonal wall.

Diagnosis.—Telangiectatic glio-sarcoma.

Remarks.—In this case one interesting feature is the apparent casual connection between the injury and the development of the tumor. Quite a few cases presenting just as distinct, apparent traumatic origin, if not more so, are found in the literature. Eichhorst records two cases in which a sarcoma of the cerebellum and a glioma of the pons followed injuries to the head in two boys, resulting in death one and one-half and eight months respectively after the trauma. Curschman, cited by the same author, observed a sarcoma develop at the site of an injury causing a fracture of the skull. Starr remarks that there seems to be no doubt that blows and falls on the head may cause intra-cranial tumors, and in fact

many writers attribute the frequent falls of children on the back of the head as explaining in part the greater numbers of tumors in the posterior cranial fossæ in early life.

The fact that the tumor has developed immediately after and is apparently the result of injury is thought by Bramwell to suggest that it is either a syphilitic growth, a sarcoma, a glioma, or a scrofulous tumor.

The length of time intervening between the receipt of the trauma and the appearance of symptoms in the case described was about six or eight months. During this time the tumor may have been latent, the general symptoms being due to the gradually increasing intra-cranial pressure and the encroachment of the growth upon the vermes, because it is only when this portion becomes affected that vertigo, nausea and vomiting and other symptoms, more or less characteristic of cellular growths, appear.

Death in this case undoubtedly occurred in coma, in consequence of the continually increasing intra-cranial pressure.

Anatomically the tumor appears to be a quite typical example of glio-sarcoma with large and embryonal blood-vessels, and consequently presenting a favorable condition for the occurrence of hæmorrhages, congestions and areas of softening, with the sudden exacerbation of symptoms usually observed on this account in similar growths; exacerbations which by some authors are utilized in the differential diagnosis between the various kinds of tumors, because they can only occur in vascular or telangiectatic growths, such as sarcoma and especially the soft varieties of glioma. This tumor illustrates well also the production of internal acquired hydrocephalus due to pressure at the base of the brain upon the veins of Galen, and perhaps upon the passage between the third and fourth ventricles.



